INEL-95/0253
Revision 2

Second Revision to the Scope of Work for the Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study

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February 2003

Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE Idaho Operations Office
Contract DE-AC07-99ID13727

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[a] Westinghouse Safety Management Solutions under subcontract to BBWI

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February 2003

Approved

2/24/03

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ABSTRACT

This *Second Revision to the Scope of Work for Operable Unit 7-13/14* provides the framework for continuing development of the comprehensive remedial investigation and feasibility study for Waste Area Group 7, which comprises the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory. General descriptions are provided of information and activities required to complete the remedial investigation and baseline risk assessment, analyze remedial alternatives, develop a feasibility study, and support remedial decision making. Scope and schedule for planned activities are outlined. Details will be developed in a subsequent revision to the *Work Plan for Operable Unit 7-13/14*.

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TABLES

ACRONYMS

ABRA	*Ancillary Basis for Risk Analysis*
AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
CSE	criticality safety evaluation
DOE-ID	U.S. Department of Energy Idaho Operations Office
EPA	U.S. Environmental Protection Agency
FFA/CO	Federal Facility Agreement and Consent Order
FS	feasibility study
IDEQ	Idaho Department of Environmental Quality
INEEL	Idaho National Engineering and Environmental Laboratory
IRA	*Interim Risk Assessment*
ISG	in situ grouting
ISTD	in situ thermal desorption
ISV	in situ vitrification
LLW	low-level waste
OCVZ	organic contamination in the vadose zone
OU	operable unit
PDSA	preliminary documented safety analysis
PERA	*Preliminary Evaluation of Remedial Alternatives*
RFP	Rocky Flats Plant
RI/BRA	remedial investigation/baseline risk assessment
RI/FS	remedial investigation/feasibility study

ROD	Record of Decision
RTD	retrieval, treatment, and disposal
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
SOW2	*Scope of Work*, Revision 2
T&FR	technical and functional requirement
TRU	transuranic
VOC	volatile organic compound
WAG	waste area group

Second Revision to the Scope of Work for the Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study

1. INTRODUCTION

Operable Unit (OU) 7-13/14 comprises the comprehensive remedial investigation and feasibility study (RI/FS) for Waste Area Group (WAG) 7 at the Idaho National Engineering and Environmental Laboratory (INEEL). Waste Area Group 7 is the Radioactive Waste Management Complex (RWMC), which includes a shallow landfill, a storage area for transuranic (TRU) waste, and miscellaneous support operations. The OU 7-13/14 RI/FS was initiated in 1995 with the development of the original *Scope of Work* (Huntley and Burns 1995) followed by the *OU 7-13/14 RI/FS Work Plan* (Becker et al. 1996). The *Revised Scope of Work* (LMITCO 1997) and the *Addendum to the Work Plan* (DOE-ID 1998) were developed to reflect changes in scope and schedule prompted by delays in the OU 7-10 interim action for Pit 9 and recommendations in the *Interim Risk Assessment* (IRA) (Becker et al. 1998). The OU 7-13/14 scope defined in the *Addendum to the Work Plan* included treatability studies and collecting cores from the waste buried in the landfill. This *Second Revision to the Scope of Work* (SOW2) describes scope and schedule modifications arising from subsequent technical and programmatic considerations identified over the last 5 years.

1.1 Objectives and Scope

The overall objective for SOW2 is to provide a framework for continuing development of a technically supported RI/FS. Three of the four specific objectives previously defined in the original *OU 7-13/14 RI/FS Work Plan* (Becker et al. 1996) remain as follows:

- Assess the nature and extent of contamination associated with WAG 7
- Estimate the current and future cumulative and comprehensive risk posed by WAG 7 and identify human health and environmental contaminants of concern (COCs)
- Develop and evaluate the appropriate remedial alternatives based on the nine Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq., 1980) criteria to address those COCs.

The fourth previously identified objective, to develop site-specific contaminant transport properties, no longer will be pursued within the OU 7-13/14 Project. However, information developed outside of the project will be incorporated to the extent practicable within the constraints of scope, schedule, and budget for completing the comprehensive RI/FS.

The U.S. Department of Energy Idaho Operations Office (DOE-ID) has conducted numerous meetings, working sessions, and conference calls with the Idaho Department of Environmental Quality (IDEQ) and the U.S. Environmental Protection Agency (EPA) to define requirements for completing the OU 7-13/14 comprehensive RI/FS. A general description of the revised plan to determine remedial actions for WAG 7 is described in this SOW2. Scope includes developing a second addendum to the work plan, completing a remedial investigation and baseline risk assessment (RI/BRA), and developing a feasibility study (FS) report, a proposed plan, and a Record of Decision (ROD). Detailed descriptions of specific tasks will be documented in the second addendum. Compared to *Revised the Scope of Work*

(LMITCO 1997) and the *Addendum to the Work Plan* (DOE-ID 1998), major changes in scope include the following:

- Replace coring through waste with installation and monitoring of Type A and Type B probes and with materials retrieved from Pit 9 by the OU 7-10 Glovebox Excavator Method Project

- Eliminate treatability studies for in situ grouting (ISG) for containment during retrieval and ex situ soil treatments

- Eliminate field-scale testing for ISG

- Develop preliminary documented safety analyses (PDSAs) and criticality safety evaluations (CSEs) for in situ thermal desorption (ISTD), ISG, and in situ vitrification (ISV)

- Use OU 7-10 Stage III information to evaluate implementability of retrieval, treatment, and disposal (RTD)

- Reduce scope of the probabilistic risk assessment to a limited set of parameters

- Eliminate further modeling for the baseline risk assessment (BRA)

- Expand modeling for evaluation of long-term risks associated with candidate remedial alternatives for the FS.

All scope and schedule issues will continue to be addressed jointly by DOE-ID, IDEQ, and EPA in accordance with the Federal Facility Agreement and Consent Order (FFA/CO) (DOE-ID 1991). This SOW2 is classified as a revision to a primary document in the Action Plan attached to the FFA/CO. The sections that follow provide general descriptions of the regulatory framework within which the comprehensive RI/FS will be conducted and the specified documents required to support remedial decisions for OU 7-13/14. Major documents include the *OU 7-13/14 RI/FS Work Plan* and addenda, the RI/BRA report, the FS report, the proposed plan, and the ROD. Associated RI/FS activities, the enforceable schedule and milestones, and the working schedule for implementing the RI/FS under the FFA/CO are discussed below.

1.2 Assumptions

Fundamental assumptions that underlie this SOW2 include the following:

- The schedule for OU 7-13/14 will be accelerated by 15 months relative to the enforceable schedule specified in the OU 7-10 Dispute Resolution (DOE 2002)

- Data produced by the OU 7-10 Pit 9 Interim Action that are available within the OU 7-13/14 accelerated schedule will be evaluated as part of the WAG 7 comprehensive RI/FS

- Additional Type A and Type B probes will be installed without significant schedule delays

- Preliminary documented safety analyses and CSEs will be sufficient to assess administrative implementability of remedial alternatives

- Pre-ROD field-scale tests will not be required to develop safety bases to evaluate remedial alternatives for the FS

- If funded, early actions to mitigate risk (e.g., surface contouring, snow removal, and ISG in non-TRU areas) will be managed and implemented as nontime-critical removal actions, and information from the actions will be incorporated into OU 7-13/14 documents

- Source term control (i.e., remediation of the buried waste and contaminated soil in the interval above the first basalt layer) will be sufficient to mitigate unacceptable risk to human health and the environment

- The selected remedy for OU 7-13/14 will include a surface barrier and institutional controls in perpetuity to manage risk from surface exposure pathways (e.g., external exposure and intrusion by humans, plants, and animals

- Additional data needs or new scope that cannot be achieved within the accelerated schedule will not be discovered during the development and implementation of the second addendum to the work plan (i.e., contingencies to address scope, schedule, and budget for new activities are not included).

2. REGULATORY FRAMEWORK

The RWMC is located in the southwestern portion of the INEEL, as shown in Figure 1. Originally established in 1952 for permanent burial of waste, the RWMC now contains the Subsurface Disposal Area (SDA), the Transuranic Storage Area, and administration and operational support areas. The SDA is a 40-ha (97-acre) shallow landfill comprising 20 numbered pits, an inactive acid pit, 58 trenches, 21 soil vault rows, and an abovegrade pad. Historical operations included permanent burial of hazardous, low-level, mixed, and TRU waste. The risk potential associated with these historical disposals is the primary focus of the OU 7-13/14 RI/FS. Current operations at the SDA are limited to low-level waste (LLW) disposal performed in compliance with contemporary regulations and waste acceptance criteria. The adjacent Transuranic Storage Area, built in 1970, is a 23-ha (56-acre) facility for temporary storage and examination of TRU waste. If contamination remains in soil after closure of the Transuranic Storage Area, residual risk will be addressed in OU 7-13/14. Administration and operational support areas cover approximately 9 ha (22 acres) and contain miscellaneous facilities such as administrative offices, maintenance buildings, and equipment storage. Figure 2 illustrates the physical layout of the RWMC.

In 1989, the INEEL was added to the EPA National Priorities List of Superfund sites (54 FR 48184, 1989) under CERCLA (42 USC § 9601 et seq., 1980). The FFA/CO (DOE-ID 1991) established the procedural framework for identifying appropriate response actions that must be implemented to protect human health and the environment in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300, 2002), CERCLA, the Resource Conservation and Recovery Act (42 USC § 6901 et seq., 1976), and the Idaho Hazardous Waste Management Act (IC 39-4401 et seq., 1993). The Action Plan attached to the FFA/CO provides the original schedule for developing, prioritizing, implementing, and monitoring response actions. Ten WAGs are listed for the INEEL with each WAG subdivided into OUs for investigation of actual and potential releases of hazardous substances. Originally comprising 14 OUs, WAG 7 now contains 13 OUs because two were combined (see Table 1).

During preparation of the FFA/CO, two types of OUs were defined for WAG 7. Some OUs were defined as contaminant exposure pathways (e.g., the air pathway and groundwater pathway) and others were defined as collections of specific release sites (e.g., non-TRU pits and trenches and TRU pits and trenches). Subsequently, however, DOE-ID, IDEQ, and EPA recognized that WAG 7 should be evaluated comprehensively to assess the cumulative risk potential for all sources within the RWMC. Because OU 7-13, the TRU pits and trenches, was the only OU in WAG 7 besides the OU 7-14 comprehensive RI/FS that had not been evaluated, the two OUs were combined into OU 7-13/14. Evaluations of WAG 7 OUs 1 through 12 are either complete or in progress. The status and type of investigation for each OU are summarized in Table 1.

Enforceable deliverables under the FFA/CO were modified for OU 7-13/14 by the OU 7-10 Dispute Resolution (DOE 2002). In accordance with Dispute Resolution requirements, the OU 7-13/14 schedule was modified. In addition, the RI/BRA and FS for OU 7-13/14 will be submitted separately and both reports are defined as primary documents under the FFA/CO. The definitions of the remaining secondary and primary documents for OU 7-13/14 were not modified.

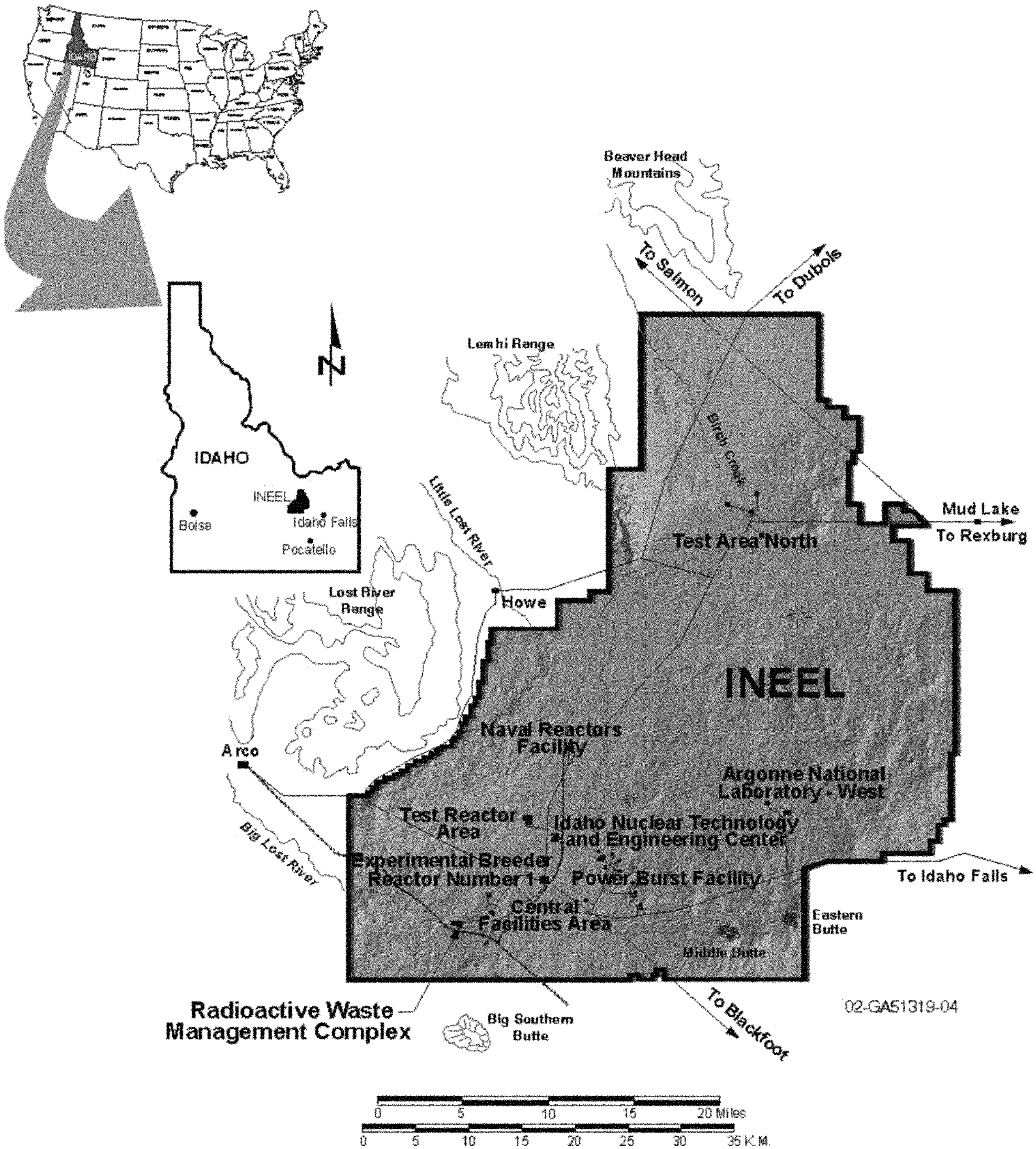

Figure 1. The Radioactive Waste Management Complex and major facilities at the Idaho National Engineering and Environmental Laboratory.

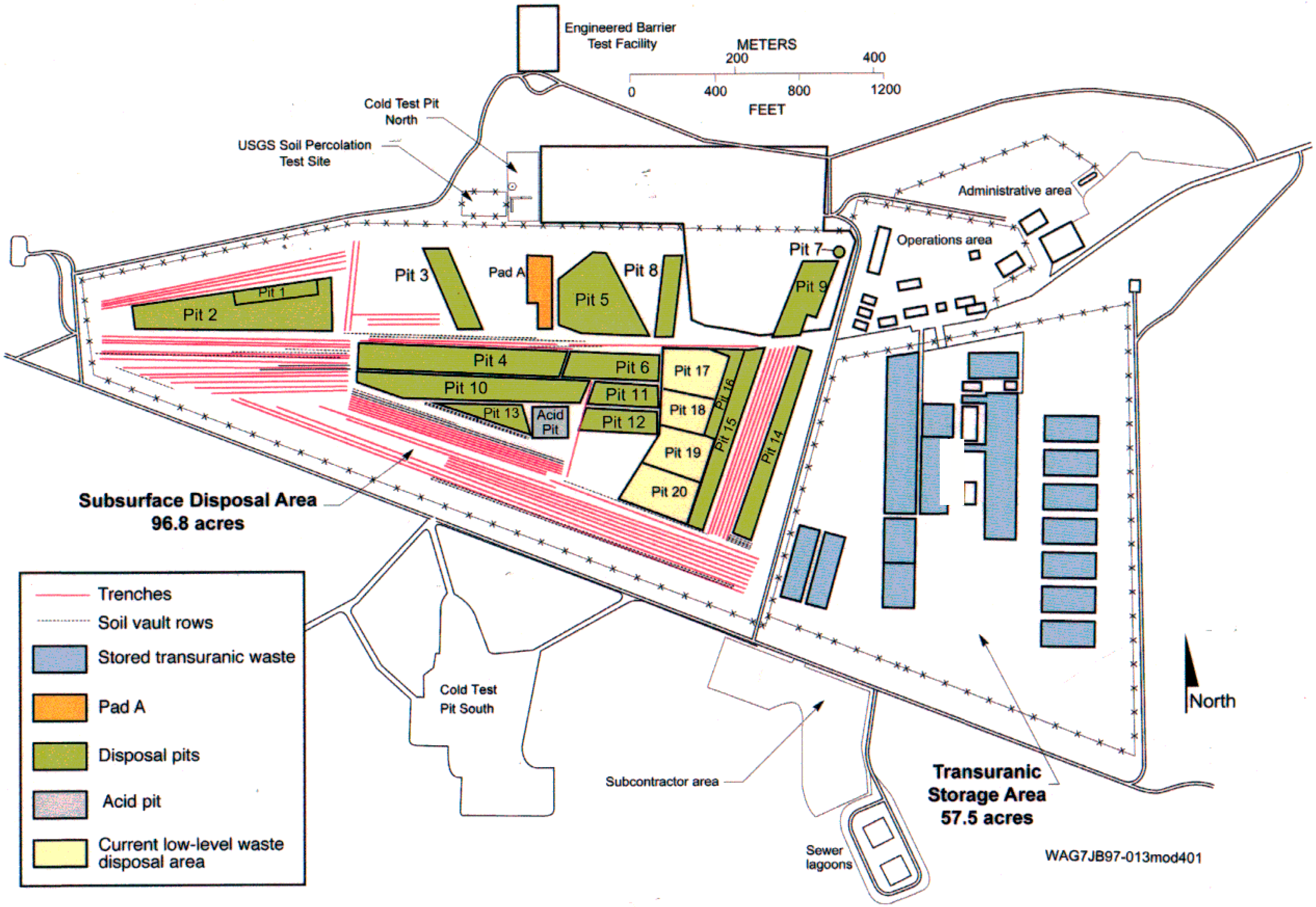

Figure 2. Physical layout of the Radioactive Waste Management Complex.

Table 1. Status of operable units in Waste Area Group 7.

Operable Unit	OU Name	FFA/CO Classification	Status[a]	Comments
OU 7-01	Soil vault rows 1-13	Track 2	✓	The Track 2 investigation, signed on 4/95, specified further evaluation in the OU 7-13/14 comprehensive RI/FS.
OU 7-02	Acid pit	Track 2	✓✓	The Track 2 investigation, signed on 11/94, specified further evaluation in the OU 7-13/14 comprehensive RI/FS. The OU was subsequently eliminated from further evaluation in the Addendum to the Work Plan (DOE-ID 1998).
OU 7-03	Non-TRU pits and trenches	Track 1	✓	The Track 1 investigation, signed on 9/93, evaluated Pits 7 and 8 and Trenches 18, 21-25, 27-31, 33, 35-38, 4-44, 46, 50, 53, 54, 57, and 58. Further evaluation in the OU 7-13/14 comprehensive RI/FS was specified. This OU also encompasses the current low-level waste disposal operations in the contiguous area comprising Pits 15 through 20.
OU 7-04	Air pathway	Track 2	✓	The preliminary scoping package, signed on 4/95, specified further evaluation in the OU 7-13/14 comprehensive RI/FS.
OU 7-05	Surface water pathways and surficial sediments	Track 2	✓	The Track 2 investigation, signed on 4/10/94, specified further evaluation in the OU 7-13/14 comprehensive RI/FS.
OU 7-06	Groundwater pathway	Track 2	✓	The Track 2 investigation, signed on 12/7/94, specified further evaluation in the OU 7-13/14 comprehensive RI/FS.
OU 7-07	Vadose zone radionuclides and metals	Track 2	✓	The preliminary scoping package, signed on 2/8/95, specified further evaluation in the OU 7-13/14 comprehensive RI/FS.
OU 7-08	Organic contamination in the vadose zone	RI/FS	●	The ROD was signed on 12/2/94. Remediation is in progress.
OU 7-09	Transuranic Storage Area releases	Track 1	✓	The Track 1 investigation, signed on 4/10/94, specified further evaluation in the OU 7-13/14 comprehensive RI/FS.
OU 7-10	Pit 9 interim action	Interim action	●	The ROD was signed on 10/1/93. Interim action remedial design is in progress.
OU 7-11	Septic tanks	Track 1	✓✓	The Track 1 investigation was signed on 1/7/93. No further action is required because no evidence of contamination was found.
OU 7-12	Pad A	RI/FS	♦	The ROD was signed on 2/1/94. Remedial action was completed by April 1995. Pad A is managed under post-remediation operation and maintenance and CERCLA reviews.
OU 7-13	TRU pits and trenches	RI/FS	✕	See OU 7-13/14. The OU 7-13 RI/FS was not implemented.
OU 7-14	Comprehensive RI/FS	RI/FS	✕	See OU 7-13/14. The OU 7-14 RI/FS was not implemented.
OU 7-13/14	Comprehensive RI/FS	RI/FS	→	The TRU pits and trenches RI/FS, OU 7-13 was combined with the comprehensive RI/FS, OU 7-14, into a single comprehensive RI/FS designated OU 7-13/14. Scoping, characterization, and treatability studies are in progress.

a. ✓ = The Track 1 or Track 2 investigation is complete. The final decision for the OU is deferred to the OU 7-13/14 comprehensive RI/FS.

● = The Record of Decision is signed. Implementation is in progress.

✓✓ = The investigation is complete. Further evaluation in the comprehensive RI/FS is not required.

♦ = The selected remedy has been implemented. Pad A waste will be evaluated with the total OU 7-13/14 source term inventory. Further action will not be required unless the Pad A remedy is not compatible with the remedies selected for OU 7-13/14.

✕ = See OU 7-13/14.

→ = The comprehensive RI/FS is in progress.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
FFA/CO = Federal Facility Agreement and Consent Order
OU = operable unit
RI/FS = remedial investigation/feasibility study
ROD = Record of Decision
TRU =transuranic

3. REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

The framework and details to implement an RI/FS are provided in an RI/FS work plan, which describes the activities specified to support development of the RI/BRA report, RI/FS report, proposed plan, and ROD. In accordance with the FFA/CO (DOE-ID 1991) and EPA guidance (EPA 1988), the *OU 7-13/14 RI/FS Work Plan* (Becker et al. 1996) and the *Addendum to the Work Plan* (DOE-ID 1998) were prepared for OU 7-13/14. The DOE-ID, IDEQ, and EPA identified the scope defined in these documents by examining data from historical and ongoing environmental monitoring, waste disposal information, and results of previous investigations. All available information was compared to data needs and the potential consequences of substituting assumptions or default values in the absence of site-specific information. The second work plan addendum will be developed similarly.

Collectively, the *OU 7-13/14 RI/FS Work Plan* (Becker et al. 1996), the *Addendum to the Work Plan* (DOE-ID 1998), and the upcoming second addendum to the work plan will provide the complete framework for implementing the OU 7-13/14 RI/FS. The requirements of each succeeding document update those of earlier versions.

3.1 Elements for the Work Plan and Addenda

Elements to be considered in the *OU 7-13/14 RI/FS Work Plan* and addenda are discussed in the following sections.

3.1.1 Assumptions for the Remedial Investigation and Feasibility Study

Previously developed assumptions for the RI/BRA and the FS (Becker et al. 1996, DOE-ID 1998) will be reevaluated in the second addendum to the work plan to assess their continued applicability. Additional assumptions will be identified as appropriate.

3.1.2 Work Conducted for Waste Area Group 7

The work conducted for WAG 7 since the *Addendum to the Work Plan* was developed will be reviewed in the second addendum and considered in combination with previously obtained information. Work activities since the *Addendum to the Work Plan* include the following:

- Evaluation of SDA inventory
- Environmental monitoring
- Installation and monitoring of additional groundwater and vadose zone monitoring wells
- Continuation of treatability studies
- Waste zone probing
- Initiation of the OU 7-10 Glovebox Excavator Method Project in Pit 9
- Continuation of column studies
- Publication of the *Ancillary Basis for Risk Analysis* (ABRA) (Holdren et al. 2002), the *Preliminary Evaluation of Remedial Alternatives* (PERA) (Zitnik et al. 2002), and other supporting documents.

3.1.3 Conceptual Site Model

A conceptual site model is used to develop a general understanding of a site to evaluate potential risks to human health and the environment and assist in identifying and setting priorities for data collection at the site. The conceptual site model presented in the *Addendum to the Work Plan* will be refined based on newly developed information, such as quantification of the influence of the spreading areas on contaminant transport beneath the SDA.

3.1.4 Characterization Activities

Appropriate planning documents (e.g., sampling and analysis plans and health and safety plans) will be developed. Probing and probehole monitoring have been identified to replace collecting the waste zone cores and corehole monitoring specified in the *Addendum to the Work Plan*. The second addendum will elaborate on probing and probehole monitoring objectives and requirements.

3.1.5 Waste Zone Mapping

Development and refinement of WasteOScope, a waste zone mapping and visualization computer tool for the SDA, will continue to completion. Locations of all available shipping records will be loaded into the data set and contaminant density functions will be incorporated. Software utilities will include data layers such as geophysics and soil gas surveys. Standardized queries will be defined and a user's manual will be developed.

3.1.6 Inventory Evaluations

Historical contaminant inventories received from Argonne National Laboratory-West, the Idaho Nuclear Technology and Engineering Center, the Naval Reactors Facility, the Test Reactor Area, and other miscellaneous INEEL operations will be reevaluated and compared to previous estimates (LMITCO 1995b, 1995c). The consequences of substantial inventory modifications on the results of the ABRA will be qualitatively assessed.

3.1.7 Remedial Investigation and Baseline Risk Assessment

The basis for the RI/BRA will include information from the ABRA as appropriate (Holdren et al. 2002). The risk estimates in the ABRA will be duplicated in the RI/BRA and applied to the analysis of remedial alternatives in the FS. Though the ABRA did not identify plutonium isotopes as COCs based on risk estimates, Pu-238, Pu-239, and Pu-240 are classified as special case contaminants of concern to acknowledge uncertainties about plutonium mobility in the environment and to reassure stakeholders that risk management decisions for the SDA will be fully protective. No additional modeling will be conducted for the RI/BRA unless warranted by inventory evaluations for INEEL facilities. The remedial investigation will include density distribution maps of all COCs. Unique waste streams (e.g., beryllium blocks and irradiated fuel materials) also will be mapped in the RI/BRA.

3.1.8 Feasibility Study

Development of general response actions, remedial action objectives, technology and process option screening, analysis of alternatives, and evaluation to the CERCLA threshold and balancing criteria were completed in the PERA (Zitnik et al. 2002). The FS will focus on refining the PERA detailed analysis of assembled alternatives to develop a comparative analysis of the benefits and deficiencies of the respective remedial alternatives. Further analysis of regulations and other guidance to identify applicable or relevant and appropriate requirements (ARARs) also will be conducted during development of the FS. Additional fate and transport modeling and risk assessments will be implemented to assess the long-term effectiveness of assembled alternatives that are analyzed in detail. Risk assessments will be used to compare the relative effectiveness of the various alternatives in mitigating threats to human and ecological receptors. If appropriate, risk reductions that may be achieved by remediating selected areas will be estimated. Assembled alternatives will differ primarily in the approach to the TRU pits and trenches and Pad A. Elements common to multiple assembled alternatives, particularly elements defined to address the remainder of the SDA, also will be described in detail.

3.1.9 Technology Evaluations

All treatability studies are completed or discontinued. Two of the five treatability studies defined in the *Addendum to the Work Plan* (DOE-ID 1998) are eliminated: (1) ISG for containment during retrieval and (2) ex situ soil treatments. Scope for the ISTD, ISV, and ISG treatability studies is redirected to preremedial design investigations. Field-scale tests will not be implemented. Instead, coupled with PDSAs and CSEs discussed in Section 3.1.10, bench-scale tests for ISTD and ISG using surrogate waste or materials retrieved from Pit 9 by the OU 7-10 Glovebox Excavator Method Project will be defined and implemented. Test plans and waste management plans will be prepared. In addition, technologies will be surveyed and evaluated to address near-term implementation in soil vaults and LLW pits and trenches to reduce risk associated with beryllium blocks, activated metal, and other types of waste in areas of the SDA that do not contain Rocky Flats Plant[b] (RFP) TRU waste. A cost estimate will be developed for a life cycle approach to grouting or encapsulating all soil vaults in the SDA. Additionally, technologies to verify performance of in situ treatment of buried waste will be identified and evaluated.

3.1.10 Preliminary Documented Safety Analyses and Criticality Safety Evaluations

Preliminary documented safety analyses will be completed for ISTD, ISG, and ISV. The PDSA for ISG will evaluate treatment of the entire SDA, except Pad A. The PDSA for ISV and ISTD will be limited to RFP TRU pits and trenches. Because design concepts for full-scale retrieval have not yet been developed, OU 7-13/14 will rely on OU 7-10 Stage III to evaluate the implementability of RTD.

Because criticality concerns are a principal safety component for determining implementability of remedial alternatives, CSEs for ISG, ISTD, and ISV will be performed in conjunction with the PDSAs. Additionally, limited design development for ISG and ISTD will be performed to support preparation of PDSA and CSE. Several technical and functional requirements (T&FRs), updated process and operational descriptions, and preconceptual confinement and shielding designs will be prepared.

3.1.11 Environmental Monitoring

Monitoring requirements for groundwater, the vadose zone, and the waste zone will be reviewed. Modifications will be identified based on the ABRA (Holdren et al. 2002).

3.1.12 Public Outreach

Fact sheets, briefings, presentations, and a web site will be developed and made available to keep stakeholders apprised of OU 7-13/14 progress.

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b. The Rocky Flats Plant is located 26 km (16 mi) northwest of Denver. In the mid-1990s, it was renamed the Rocky Flats Environmental Technology Site. In the late 1990s, it was again renamed, to its present name, the Rocky Flats Plant Closure Project. Most of the transuranic waste in the Subsurface Disposal Area originated at the Rocky Flats Plant.

4. REMEDIAL INVESTIGATION AND BASELINE RISK ASSESSMENT

An RI/BRA report will be prepared that summarizes the background information, physical setting, nature and extent of contamination, and baseline risks associated with OU 7-13/14. Results of the fate and transport modeling and risk assessments developed for the ABRA will be presented in the RI/BRA. Unlike most RI/BRA reports, the OU 7-13/14 RI/BRA is classified as a primary rather than a secondary document under the FFA/CO, in accordance with the OU 7-10 Dispute Resolution (DOE 2002). The RI/BRA will contain the information necessary to focus the FS for OU 7-13/14 and will be prepared in accordance with the suggested RI/BRA format presented in EPA guidance (EPA 1988).

4.1 Basis for the Remedial Investigation

Typically, the remedial investigation component comprises the first four sections of the RI/BRA report: (1) introductory information such as scope, objectives, and regulatory background; (2) descriptions of physical characteristics of the site, including geology, hydrology, meteorology, demography, and land use; (3) summaries of investigations that support the RI/BRA such as field investigations, laboratory studies, and literature research; and (4) analysis of nature and extent of contamination, which is a contaminant- and media-specific evaluation of source term data and environmental monitoring. The first four sections of the ABRA (Holdren et al. 2002) will be updated and published for the remedial investigation. In general, work completed subsequent to publication of the ABRA will be incorporated. Specific enhancements for the remedial investigation are discussed below.

4.1.1 Waste Zone Mapping

The WasteOScope mapping and visualization tool is being developed to improve characterization of the SDA. All available records are being reviewed to map individual waste shipment locations in the SDA based on reconstruction of historical operations, shipment manifests, waste disposal forms, and process knowledge.

Most of the pre-1970 disposals from RFP, the source of the majority of TRU waste in the SDA, have been reconstructed and input into WasteOScope. Locations and distributions of RFP shipments and waste streams can be readily illustrated. A density function to illustrate contaminant inventories in various areas of the SDA is now being developed. Upon completion, the density function will estimate contaminant inventories associated with various shipments and waste streams to show relative concentrations of various contaminants in TRU pits and trenches. Maps showing the RFP COCs and total TRU densities in the SDA will be incorporated in the remedial investigation. To the extent practicable with available data, density maps will illustrate those areas in the SDA with expected TRU concentrations greater than 100 nCi/g.

Disposals received from INEEL facilities also are being mapped. Several COCs identified in the ABRA, such as C-14 and Tc-99 are contained in remote-handled LLW. Though pre-1970 INEEL waste is intermingled with RFP waste and can not be readily discriminated, most of the INEEL waste is located in non-TRU pits, trenches, and soil vaults. Other INEEL waste streams, such as beryllium blocks and irradiated fuel materials, may require separate analysis in the FS. To the extent practicable with existing information, WasteOScope will be used to produce maps for the remedial investigation that illustrate locations and densities of waste originating at the INEEL.

Various data layers are available that can be superimposed on waste shipment locations in WasteOScope. Of particular interest are maps showing locations of Type A and Type B probes, geophysical signatures in the SDA, soil gas surveys, disposal unit boundary surveys, and topography. Information presented in the ABRA will be updated with subsequent data and presented in the RI/BRA report.

4.1.2 Additional Type A and Type B Probing and Data Evaluation

Data collection and interpretation from new and existing Type A and Type B probes in the SDA will be included in the scope defined in the second addendum. In addition to compiling and interpreting monitoring data from the Type B lysimeters and moisture probes, information from Type A probe logging will be reviewed to determine if credible mass estimates, mass ranges, improved verification of waste type, or other useful information can be developed.

The feasibility of calibrating the logging will be assessed by reviewing possible calibration strategies and the potential use of waste material retrieved from Pit 9. Limitations of logging data and calibration uncertainties will be assessed to determine if Type A probes can be used to define areas with TRU concentrations. Alternative methods also will be considered. Specific scope will be developed and presented in the second addendum.

The Type B probe monitoring network in the SDA will be expanded. The same process used to select locations for existing Type B probes will be implemented. First, shipment records will be examined to locate target waste streams. Geophysical survey results and other data will be reviewed for corroboration. Type A probes then will be installed to verify that the target waste stream is being penetrated by the probes. Type B probe clusters will be installed at the validated locations to provide additional waste zone monitoring capabilities. Preliminary locations for the additional probes will be refined in the second addendum. Initially, targets include (1) uranium and plutonium areas in Pit 5, (2) near the existing Probe 741-08 in Pit 10, (3) an irradiated fuel materials disposal location, (4) near an area of liquid waste disposal, (5) near known areas of unrecorded waste identified during site characterization (e.g., magnetic surveys and well installation), and (6) a uranium disposal in the west end of the SDA to investigate uranium detections in the shallow vadose zone.

4.1.3 Updates to the Nature and Extent of Contamination

The ABRA presents a snapshot of the nature and extent of contamination associated with WAG 7 as of 2001. Though vapor-phase volatile organic compounds (VOCs) are clearly attributable to waste buried in the SDA, monitoring data do not provide conclusive evidence about dissolved-phase contaminant transport. Possible exceptions are anthropic uranium and nitrate, which appear to be migrating into the vadose zone and Snake River Plain Aquifer from the SDA. Adequate resolution for the ambiguities are necessary to focus analysis of remedial alternatives in the FS on the appropriate waste streams. Ambiguities will be resolved by augmenting the ABRA with additional information produced by continued monitoring, waste zone mapping, inventory updates, and other activities. Specific ambiguities include the following:

- Uranium ratios in the vadose zone indicate a mixture of enriched and depleted uranium. Depleted and enriched uranium are associated with RFP roaster oxides and with INEEL reactor operations waste, respectively.

- Sporadically detected plutonium in the vadose zone may be present in ratios that imply reactor-grade plutonium. The RFP waste would contain Pu-239 and Pu-240 isotopes from weapons production, whereas Pu-238 is associated with nuclear reactors and would be attributable to INEEL reactor operations waste.

- Vadose zone monitoring data for I-129 and Tc-99 are inconclusive and it is unclear whether these two contaminants are present in the vadose zone. These contaminants are contained in INEEL waste.

- Carbon-14 is detected in the aquifer north and east of the SDA in the direction traditionally considered upgradient. Most C-14 in the SDA was generated at the INEEL.

Modeling for the ABRA showed that C-14, I-129, and Tc-99 associated with INEEL LLW may pose an imminent threat to groundwater quality. Evaluation of the nature and extent of contamination in the ABRA concluded, based on monitoring data, that release of fission and activation products may be occurring. Though model calibration for the ABRA was limited and detected concentrations are substantially less than simulated concentrations, LLW COCs may be migrating into the vadose zone.

The second addendum will specify that monitoring data from the Type B probes, vadose zone, and aquifer will be reviewed and interpreted after each new data set is received to assess developing trends. Quarterly monitoring will produce several additional data sets for the remedial investigation, and the snapshot developed for the ABRA will be updated to incorporate the additional interpretation of the nature and extent of contamination. Information in the remedial investigation will be used to validate the conceptual site model, calibrate source release and transport models for the FS analysis of long-term effectiveness, and reduce uncertainty associated with identifying waste streams that must be targeted in the FS to provide long-term protection of human health and the environment.

4.1.4 Data from the OU 7-10 Glovebox Excavator Method Project Retrieval

The OU 7-10 Glovebox Excavator Method Project will retrieve approximately 57 m^3 (75 yd^3) of waste and interstitial soil from Pit 9 and will collect five underburden cores to assess contaminant release from buried waste (Salomon et al. 2003). Though data from Pit 9 will not be representative of the entire SDA, the retrieval provides an opportunity to develop valuable information.

Retrieved waste and interstitial soil (i.e., soil from the waste zone) will be subsampled and analyzed by the OU 7-13/14 Project. The physical and chemical forms of the waste will be evaluated to assess VOC content, moisture content, oxidation states, and contaminant solubilities. Interstitial soil will be analyzed to quantify concentrations released from the waste. Comparisons of waste concentrations to interstitial soil concentrations will provide information about the magnitude of release, which will be used to assess uncertainty in the ABRA results and to evaluate parameter values for FS models.

Underburden samples and VOC samples from the waste zone will be collected and analyzed by the OU 7-10 Project in consultation with OU 7-13/14 to define requirements. Five underburden core samples and a duplicate core sample up to 5 ft long will be collected. The core barrel will be prepared to minimize the disturbance of the underburden samples so that profiles with depth can be reconstructed. If plutonium is present in the underburden, plutonium valence states will be determined and the presence of complexing agents will be assessed to evaluate migration potential. Similar analyses will be conducted for other COCs detected in the underburden.

Pursuit of site-specific contaminant transport properties is outside the scope for the OU 7-13/14 RI/FS. However, data developed by the OU 7-10 Project will be incorporated to the extent practicable within the constraints of scope, schedule, and budget for completing the comprehensive RI/FS. Results of the waste zone and underburden samples will be used in the remedial investigation to improve the physical description and enhance characterization of the nature and extent of contamination in the waste zone and underlying soil. Based on schedule constraints and the limited representativeness of Pit 9 data, evaluation will be limited to qualitative sensitivity and uncertainty analysis.

4.2 Basis for the Baseline Risk Assessment

The BRA component of the OU 7-13/14 comprehensive RI/BRA will combine the dissolved-phase analysis presented in the ABRA (Holdren et al. 2002) with additional analysis for VOCs to be produced by OU 7-08, the Organic Contamination in the Vadose Zone (OCVZ) Project. The COCs identified in the ABRA, shown in Table 2, comprise the complete set of contaminants that will be presented in the BRA. The OU 7-08 VOC modeling will account for revised estimates of original VOC inventories and for the mass of VOCs removed from the vadose zone by OCVZ remediation. Additional modeling of

Table 2. Identification of contaminants of concern and 1,000-year peak risk estimates for a hypothetical future residential exposure scenario.

Contaminant	Note[a]	Peak Risk	Year	Peak Hazard Index	Year	Primary 1,000-Year Exposure Pathway
Ac-227		3E-06	3010[b]	NA[c]	NA	Groundwater ingestion
Am-241	1,3	3E-05	2953	NA	NA	Soil ingestion, inhalation, external exposure, and crop ingestion
Am-243		4E-08	3010[b]	NA	NA	External exposure
C-14	1,4	6E-04	2278	NA	NA	Groundwater ingestion
Cl-3[illegible]		6E-06	2110	NA	NA	Groundwater ingestion
Cs-137		5E-06	2110	NA	NA	External exposure
I-129	1,3	6E-05	2110	NA	NA	Groundwater ingestion
Nb-94	1,3	8E-05	[illegible]10[b]	NA	NA	External exposure
Np-237	1,4	4E-04	3010[b]	NA	NA	Groundwater ingestion
Pa-231		3E-06	3010[b]	NA	NA	Groundwater ingestion
Pb-210		5E-07	3010[b]	NA	NA	Soil and crop ingestion
Pu-238	2		2286	NA	NA	Soil and crop ingestion
Pu-239	2		3010[b]	NA	NA	Soil and crop ingestion
Pu-240	2		3010[b]	NA	NA	Soil and crop ingestion
Ra-226		3E-06	3010[b]	NA	NA	External exposure
Sr-90	1,4		2110	NA	NA	Crop ingestion
Tc-99	1,4	4E-04	2110	NA	NA	Groundwater ingestion and crop ingestion
Th-229		4E-07	3010[b]	NA	NA	Groundwater ingestion
Th-230		7E-07	3010[b]	NA	NA	Groundwater ingestion
Th-232		1E-09	3010[b]	NA	NA	Crop ingestion
U-233	1,3	3E-05	3010[b]	NA	NA	Groundwater ingestion
U-234	1,4	2E-03	3010[b]	NA	NA	Groundwater ingestion
U-235	1,4	1E-04	2662	NA	NA	Groundwater ingestion
U-236	1,4	1E-04	3010[b]	NA	NA	Groundwater ingestion
U-238	1,4	3E-03	3010[b]	NA	NA	Groundwater ingestion
Carbon tetrachloride	1,5	2E-03[d]	2105	[illegible]E+01[d]	2105	Inhalation and groundwater ingestion
Methylene chloride	1,3	2E-05[d]	2185	1E-01[d]	2185	Groundwater ingestion
Nitrates	1,6	NA	NA	1E+00	2120	Groundwater ingestion
Tetrachloroethylene	1,6	NA	1952	1E+00[d]	2137	Groundwater ingestion and dermal exposure to contaminated water

a. Notes: For toxicological risk, the peak hazard index is given, and for carcinogenic probability, the peak risk is given.
1. Green = the contaminant is identified as a human health contaminant of concern based on carcinogenic risk greater than 1E-05 or a hazard index greater than or equal to 1 contributing to a cumulative hazard index greater than 2.
2. Brown = plutonium isotopes are classified as special case contaminants of concern to acknowledge uncertainties about plutonium mobility in the environment and to reassure stakeholders that risk management decisions for the Subsurface Disposal Area will be fully protective
3. Blue = carcinogenic risk between 1E-05 and 1E-04
4. Red = carcinogenic risk greater than 1E-04
5. Pink = toxicological (noncarcinogenic) hazard index greater than or equal to 1.
6. Gray = preliminary results from modeling based on inventory corrections indicate Cl-36 risk is 1E-05. If results are validated, Cl-36 will be identified as a contaminant of concern in accordance with Criterion 3.

b. The peak groundwater concentration does not occur before the end of the 1,000-year simulation period. Groundwater ingestion risks and hazard indices were simulated for the peak concentration occurring within 10,000 years and are not presented in this table.
c. NA = not applicable.
d. The risk estimates were produced by scaling results from the *Interim Risk Assessment* (Becker et al. 1998) based on inventory updates.

dissolved-phase contaminants will not be performed for the BRA and dissolved-phase risk estimates will not be modified to account for possible vapor-phase transport of C-14, I-129, and Tc-99.[c]

The scope for the BRA is predicated on two major assumptions:

- Risk estimates either will be taken directly from the ABRA or will be produced by simple linear scaling of ABRA results (i.e., additional exposure scenarios, inventory reevaluations, or other factors will not generate requirements for additional fate and transport modeling).

- Toxicity parameters used in the ABRA will not be substantially modified before the BRA is developed.

4.3 Human Health Evaluation

The BRA will reiterate the ABRA or linearly scaled ABRA results for radionuclides and nitrate and will incorporate updated results for VOCs provided by OU 7-08. The ABRA assessed human health risk for a hypothetical scenario where no mitigative measures are in place to restrict exposures. Essentially the same modeling techniques developed for the IRA (Magnuson and Sondrup 1998; Becker et al. 1998) were applied in the ABRA. Source term inventory refinements and other minor improvements were implemented. In accordance with EPA guidance (EPA 1989a) and the INEEL protocol for cumulative risk assessments (LMITCO 1995a), the human health evaluation in the ABRA implemented a four-step process: (1) data collection and evaluation, (2) exposure assessment, (3) toxicity assessment, and (4) risk characterization.

4.3.1 Data Collection and Evaluation

The ABRA was based on RWMC waste disposal inventories. Modeled concentrations were used to estimate future risks. The analysis adopted best-estimate inventories for actual disposals from 1952 to 1999 and maximum allowable inventories for the ongoing LLW disposal operation in Pits 17 through 20.

Data collected from all previous investigations and any new data collected subsequent to publication of the *Addendum to the Work Plan* were evaluated in the ABRA modeling to achieve the following objectives:

- Identify contaminants that are present and their concentrations, and describe the nature and extent of contamination

- Determine whether contamination levels are greater than background concentrations

- Determine whether data are adequate to identify and examine exposure pathways

- Determine whether data are adequate to characterize exposure pathways.

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c. During a meeting on July 18, 2002, personnel from DOE-ID, IDEQ, and EPA determined that additional modeling to refine risk estimates for dissolved-phase radioisotopes is not warranted. Therefore, additional modeling to evaluate vapor-phase fractions for contaminants modeled for dissolved-phase transport will not be implemented for the RI/BRA. However, additional modeling may be required to assess long-term effectiveness for the FS. This SOW2 formalizes that determination.

4.3.2 Exposure Assessment

An exposure assessment was conducted in the ABRA to estimate the magnitude of actual and potential human exposures, exposure durations, and pathways by which humans may be exposed to cumulative health risks based on current and future land-use projections (DOE-ID 1996). The exposure assessment analyzed contaminant releases, identified potentially exposed populations, identified potential pathways of exposure, estimated exposure-point concentrations for specific pathways based on environmental modeling data and fate and transport modeling, and estimated contaminant intakes for specific pathways. Results of the exposure assessment describe pathway-specific intakes for current and future exposures to contaminants of potential concern.

Contaminant fate and transport modeling was implemented to simulate future concentrations of SDA contaminants in various environmental media. The ABRA model was based on best-estimate quantities in the RWMC waste disposal inventory reports (LMITCO 1995b, 1995c; Little et al. 2001) and preliminary inventory revisions. Modeled concentrations were used to estimate risks in the ABRA using the same models as those used in the IRA.

Modeled environmental processes include release of contaminants from waste buried in the SDA, transport of contaminants in unsaturated and saturated zones beneath the SDA, suspension of contaminants in air above the SDA, and biotic uptake of contaminants from buried waste. To ensure that models provide technically defensible results, each code used for modeling was validated against test problems that have known solutions. Limited calibration to site-specific environmental conditions was achieved in the IRA (Becker et al. 1998; Magnuson and Sondrup 1998).

For the ABRA, limited model refinements and additional characterization and monitoring data produced subsequent to the IRA modeling were incorporated. However, additional model calibration was not attempted. Data sets from the Type B probe network were too small to calibrate the source release model. Vadose zone and aquifer concentrations above background values are sparse and trends are not apparent. Such patterns are poor targets for model calibration.

Risk estimates developed in the ABRA were based on the reasonable maximum exposure as defined by the EPA (EPA 1989a). Fate and transport modeling was used to estimate future concentrations at the source and in adjacent areas that may become contaminated because of contaminant transport.

4.3.3 Toxicity Assessment

The toxicity assessment presented in the ABRA summarizes relevant toxicity information for contaminants of potential concern. Toxicity data, in conjunction with exposure assessment results, were used to characterize risks. The primary sources of the toxicity data were the EPA online database (EPA 1996) and EPA *Health Effects Assessment Summary Tables* (EPA 1994). Other sources of information included the Agency for Toxic Substances and Disease Registry, Occupational Safety and Health Administration (29 CFR 1910, 2002) permissible exposure limits, American Conference of Government Industrial Hygienists threshold limit values (ACGIH 1999), and EPA maximum contaminant levels (40 CFR 141, 2002, Subpart B). The toxicity assessment in the ABRA will be duplicated in the BRA, a strategy predicated on the assumption that toxicity parameters will not be substantially modified in the interim.

4.3.4 Risk Characterization

Results of exposure and toxicity assessments were integrated to estimate cumulative risk to humans. Noncarcinogenic and carcinogenic risk estimates were calculated for contaminants of potential concern in accordance with EPA guidance (EPA 1989a).

Uncertainties and limitations are inherent in contaminant concentration data, toxicity values, fate and transport modeling, and exposure scenarios. Uncertainties associated with the risk assessment process were discussed qualitatively in the ABRA and will be repeated in the OU 7-13/14 RI/BRA in accordance with EPA guidance (EPA 1989a).

Sensitivity refers to change in predicted risk caused by changing model input parameters. As part of ABRA fate and transport modeling, a sensitivity analysis was conducted in which key modeling parameters were varied slightly to assess impacts on simulated risk.

A probabilistic risk assessment was identified in the *OU 7-13/14 RI/FS Work Plan* and *Addendum to the Work Plan* to quantify uncertainties associated with the BRA. Subsequently released EPA guidance (EPA 1999a) indicates that a complete, formal probabilistic risk assessment is not appropriate for the OU 7-13/14 comprehensive RI/FS because the decision to take action is already clear. However, probabilistic analysis may be appropriate for selected contaminants if additional information on either variability or uncertainty could lead to a different decision for remedial action that targets those contaminants. Therefore, the second addendum will include a task to identify what parameters, if any, should be assessed using probabilistic techniques. A probabilistic risk assessment is a separate modeling activity performed using BRA sensitivity results to select those model parameters that dominate risk estimates.

4.4 Ecological Risk Assessment

The ABRA includes a limited ecological risk assessment that will be referenced or duplicated without modification in the BRA. Contaminant screening was conducted to identify those contaminants that could cause adverse ecological effects. The risks to ecological receptors posed by identified COCs were estimated based on EPA guidance (EPA 1992) and general methodology developed in the INEEL guidance manual for ecological risk assessment (VanHorn, Hampton, and Morris 1995). However, some aspects of the methodology were modified to allow a limited evaluation of ecological risk rather than a complete ecological risk assessment.

Scope of the ecological risk evaluation in the ABRA was limited because of the fundamental assumption that the SDA will be covered with a cap (DOE-ID 1998). Current-year and 100-year scenarios were evaluated for representative receptors. Contaminant screening was performed to limit evaluation to those contaminants with a maximum likelihood to pose unacceptable risk. Concentrations in surface soil and subsurface intervals were estimated with the DOSTOMAN biotic uptake model. Receptor exposures were evaluated for all WAG 7 radionuclide COCs and a suite of representative nonradionuclide COCs. Unacceptable ecological risk was defined as a hazard quotient for any receptor greater than 1 for radionuclides and greater than 10 for nonradionuclides. Seven contaminants were shown to pose unacceptable risk to WAG 7 ecological receptors: Am-241, Pu-239, Pu-240, Sr-90, cadmium, lead, and nitrate. As shown in Table 3, current risk from subsurface contamination exists and, without remedial action, will continue throughout the 100-year-simulated period of institutional control and beyond.

Plant uptake and burrowing by animals are not shown to increase current surface soil concentration levels above ecologically-based screening levels during the next 100 years. However, current and ongoing risk exists as a result of (1) toxic exposures for plants with roots reaching surface and subsurface contamination, (2) ingestion exposures for animals eating those plants, (3) external and inhalation exposures for burrowing animals that feed aboveground, (4) external, inhalation, and ingestion exposures for belowground feeders, and (5) ingestion exposures for predators preying on animals contaminated on the SDA.

Table 3. Summary of ecological risk evaluation results for subsurface soil contamination.

Nonradionuclide Contaminant	Hazard Quotient[a] Current Scenario	Hazard Quotient[a] 100-year Scenario	Radionuclide Contaminant	Hazard Quotient[a, b] Current Scenario	Hazard Quotient[a, b] 100-year Scenario
Cadmium	<1 to <9	<1 to 20	Am-241	<0.1 to 21	0.7 to 41
Lead	<1 to <6	<1 to 20	Pu-239	NA	<0.1 to >1
Nitrate	<1 to >10	< 0.1	Pu-240	NA	<0.1 to >1
			Sr-90	<0.1 to >25	NA

NA— Concentrations for this contaminant did not exceed the ecologically-based screening level. Therefore, it was not evaluated in the ecological assessment as a contaminant of potential concern for the given scenario.

a. Values represent the range of maximum hazard quotients calculated across receptor functional groups and species.

b. The range represents hazard quotients for both internal and external exposures.

Ecological risk will be addressed by actions implemented to reduce human health risk. Installation of a cap that also incorporates a biotic barrier will serve to inhibit plant and animal intrusion into contaminated subsurface media, protect ecological receptors from long half-lived radionuclides and nonradionuclide contaminants, and reduce human exposures by preventing biotic transport of contamination to the surface.

5. FEASIBILITY STUDY

The FS will be conducted in parallel with the RI/BRA, as stated in EPA RI/FS guidance (EPA 1988). In accordance with the OU 7-10 Dispute Resolution (DOE 2002) the OU 7-13/14 RI/BRA and FS will be published in two separate, primary documents. Scope of the FS is limited to assessing source term control based on the assumption that source term control will sufficiently reduce risk. If it is subsequently determined that source term control alone is inadequate in reducing risk, additional remedial actions will be considered in accordance with the CERCLA process. All information used to screen, develop, and assemble remedial alternatives for OU 7-13/14 and information that forms the basis for identifying a preferred alternative for OU 7-13/14 in the proposed plan will be summarized in the FS report. Elements of the FS will follow the basic format presented in EPA guidance (EPA 1988).

Initial development of the FS has been completed in the PERA (Zitnik et al. 2002). The PERA presents a complete development and assembly of remedial alternatives for RFP TRU waste. Future FS work will focus on rigorous detailed analysis of the assembled alternatives and on the development of a balanced comparative analysis. The FS will incorporate information that is available from OU 7-13/14 preremedial design investigations, PDSAs, CSEs, T&FRs, OU 7-10 Stage II and Stage III projects, and other available sources.

5.1 Development of Remedial Alternatives

Remedial technologies and process options that remained after initial development and screening in the PERA will be explored further during the FS. Technologies and options were combined into assembled alternatives to address areas within WAG 7 that pose unacceptable cumulative risk. A range of alternatives was developed to represent distinct, viable approaches to reduce risk to acceptable levels. Focusing on approaches to address the RFP TRU waste, the PERA incorporated presumed ISG and capping for other areas of the SDA. A No Action alternative also was developed to serve as a baseline against which to compare the range of alternatives. Alternatives for remediation were developed in the PERA by evaluating combinations of technologies following the six general steps outlined by the EPA (EPA 1988) listed below:

1. Develop remedial action objectives
2. Develop general response actions for each medium of interest
3. Identify volumes or areas of media to which general response actions might be applied
4. Identify and screen technologies applicable to each general response action
5. Identify and evaluate technology process options to select a representative process for each technology type retained for consideration
6. Assemble the selected representative technologies into alternatives representing a range of treatment combinations to remediate the SDA.

Results of the PERA will be duplicated in the FS. Modifications justified by additional information produced by treatability studies, PDSAs, CSEs, and other sources will be incorporated. However, scope for the FS is defined based on the assumption that additional information will have no impact on the preliminary development of remedial action objectives, general response actions, identification of technologies, and assembly of alternatives. Upgrades to the WasteOScope mapping tool will generate refinements to volumes and areas in the SDA that may require remediation. Currently, it is assumed that the impact of the refinements will be limited to cost estimates for various assembled alternatives. However, evaluations in the FS for additional in situ remedial alternatives for other INEEL buried waste streams (e.g., beryllium blocks and irradiated fuel materials) also may be indicated.

5.2 Preremedial Design Investigations

Preremedial design investigations to address technology-specific administrative implementability and effectiveness will be defined in the second addendum. To address administrative implementability PDSAs and CSEs will be completed for ISTD, ISG, and ISV. Technology effectiveness will be addressed by bench-scale testing as well as evaluating technologies to treat waste in the soil vaults and low-level pits and trenches and for verifying performance of in situ treatment. Additional investigations to assess effectiveness for specific technologies will be dependent on availability of qualified technology vendors, adequate facilities, and the definition of appropriate tests. If a decision to perform pre-ROD remediation in the non-TRU areas is implemented, the preremedial design investigations will be conducted as expeditiously as possible to ensure information to support the remedial action will be available.

5.2.1 Administrative Implementability—Preliminary Documented Safety Analysis

To assess the administrative implementability of the various remediation technologies, PDSAs and CSEs will be developed to provide a technology-specific safety basis for each core technology except for containment and RTD included in the assembled alternatives. Sufficient experience-based knowledge for containment is available, thus precluding the need for a PDSA. For RTD, OU 7-13/14 will rely on OU 7-10 Stage III to evaluate the implementability of retrieval, ex situ treatment, and disposal of waste from the RFP TRU pits and trenches.

The PDSA and CSE for ISTD will develop the safety basis for pretreating VOC waste streams in RFP TRU pits and trenches. Initial design elements to support development of the PDSA and CSE include preparation of T&FRs, updated process and operational descriptions, and preconceptual thermal well-casing and off-gas design. Analysis of ISTD application to a new disposal unit within the area of contamination (AOC) for waste removed from Pad A also may be appropriate.

The PDSA and CSE for ISG will address grouting in all areas of the SDA, including a newly constructed disposal unit for waste removed from Pad A. Initial design elements to support development of the PDSA and CSE include preparation of T&FRs, updated process and operational descriptions, and preconceptual confinement and shielding design. Grouting in non-TRU pits, trenches, and soil vaults is a common element for all assembled alternatives. Therefore, the ISG PDSA will examine issues associated with technology implementation in remote-handled waste in addition to addressing RFP TRU pits and trenches.

The PDSA and CSE for ISV will be limited to RFP TRU pits and trenches and a newly constructed disposal unit within the AOC for waste removed from Pad A. Issues associated with implementation of ISV in heterogeneous wastes buried in the SDA will be examined.

5.2.2 Technology Effectiveness—Bench-Scale Testing and Technology Evaluation

The second addendum to the work plan will include a task to define appropriate bench-scale tests to assess effectiveness of ISTD and ISG on various SDA waste streams.The tests will be defined in the second addendum, which will address objectives, test plans, and waste management plans residual materials. A combination of tests on surrogate waste and waste retrieved from Pit 9 is being examined.

Bench-scale tests on surrogate or retrieved waste will be conducted to assess effectiveness and performances on in situ treatments. According to the accelerated schedule (see Section 9), materials retrieved by the OU 7-10 Glovebox Excavator Method Project will be available to OU 7-13/14 beginning October 2003. Bench-scale hot tests on retrieved waste could generate higher confidence than tests performed on surrogate waste for those technologies under consideration for TRU pits and trenches. However, outstanding data gaps, if any, may not be significant enough to warrant bench-scale hot tests with retrieved waste, particularly if a viable and cost-effective disposal option is not available for the treated waste generated by the tests.

Technologies for in situ treatment of the activation and fission product waste in the soil vaults and LLW pits and trenches will be identified and evaluated. Bench-scale tests on surrogate waste or actual waste samples will be performed to assess effectiveness of ISG on activation and fission product waste (e.g., beryllium blocks and remote-handled LLW). Parameters and characteristics of surrogate waste will be defined in test plans. Bench-scale testing will be an important phase, particularly if future field-scale tests for soil vaults are needed to support remedial design or nontime critical removal actions. A life cycle cost estimate also will be developed for treating all soil vaults in the SDA.

5.3 Evaluation of Remedial Alternatives

Five alternatives were developed for detailed analysis in the PERA: No Action, Containment, ISG, ISV, and RTD. All alternatives except the No Action alternative are combinations of remedial actions. The assembled alternatives differ primarily in the approach to mitigating risk posed by TRU waste from RFP. Remedial actions common to all assembled alternatives and descriptions of individual alternatives are provided below, followed by a summary of the criteria against which alternatives will be measured in the FS detailed and comparative analyses.

5.3.1 Common Remedial Actions for All Assembled Alternatives

The No Action alternative is limited to environmental monitoring. The four assembled alternatives, Containment, ISG, ISV, and RTD, have the following remedial actions in common:

- Pad A retrieval and complete or partial disposal within the AOC
- Pretreatment of the buried RFP waste to destroy VOCs
- Continued operation of OCVZ vapor vacuum extraction until source term control is achieved and vadose zone remedial action objectives for OU 7-08 are satisfied
- In situ grouting of the non-RFP waste that poses risk from C-14, I-129, Nb-94, Tc-99, and uranium
- Pretreatment with ISG to mitigate subsidence throughout the SDA
- Containment by capping, with the robustness of the cap and the size of the associated restricted access area dependent on the approach to RFP TRU, and modifications to the exisiting OCVZ system to accommodate vadose zone remediation
- Long-term operations, maintenance, monitoring, and institutional controls.

5.3.2 Assembled Alternatives

Core technologies to address RFP TRU are integrated into assembled alternatives. In addition to the common remedial actions described above, primary features of the assembled alternatives are as discusssed in the following subsections.

5.3.2.1 Containment. The containment alternative in the PERA evaluates a cap with design requirements similar to those defined for the INEEL CERCLA Disposal Facility. Other cap designs also may be considered in the FS.

5.3.2.2 In Situ Grouting. The ISG alternative evaluates grouting RFP TRU waste to immobilize contaminants. Waste on Pad A would be transferred to a new excavation within the AOC and grouted. A modified RCRA cover or other type of cap would be installed over treated areas and extended to cover the remainder of the SDA.

5.3.2.3 In Situ Vitrification. The ISV alternative evaluates application of ISV to RFP TRU waste to immobilize contaminants. Waste on Pad A would be transferred to a new excavation within the AOC and vitrified. A modified RCRA cover or other type of cap would be installed over treated areas and extended to cover the remainder of the SDA.

5.3.2.4 Retrieval, Treatment, and Disposal. The RTD alternative evaluates excavating, sorting, treating and disposing of RFP TRU waste, including Pad A. Retrieved and treated materials would be dispersed to appropriate facilities on and off the INEEL in accordance with various waste acceptance criteria. Candidate facilities off the INEEL include the Waste Isolation Pilot Plant, the Nevada Test Site, and Envirocare. Candidate facilities on the INEEL include the INEEL CERCLA Disposal Facility, the Central Facilities Landfill, and a newly constructed disposal cell at the RWMC. An INEEL CERCLA Disposal Facility cover or other type of cap would be placed over the new disposal cell. The remainder of the SDA also would be capped.

5.3.3 Evaluation Using Compehensive Environmental Response, Compensation, and Liability Act Criteria

Potential remedial technologies and process options were identified in the PERA by listing appropriate technologies for OU 7-13/14 and then evaluating the technologies individually and comparatively against threshold, balancing, and modifying criteria defined by the EPA (EPA 1988) in accordance with the National Contingency Plan (40 CFR 300, 2002). Threshold and balancing criteria will be assessed in the FS in the detailed analysis. Modifying criteria will be evaluated in the proposed plan and ROD. The nine threshold, balancing, and modifying criteria are listed below:

- Threshold criteria

  1. Overall protection of human health and the environment

  2. Compliance with ARARs

- Balancing criteria

  3. Long-term effectiveness and permanence

  4. Reduction in toxicity, mobility, and volume of contaminants through treatment

5. Short-term effectiveness

6. Implementability

7. Cost

- Modifying criteria

8. State acceptance

9. Community acceptance.

5.4 Analysis of Applicable or Relevant and Appropriate Requirements

Identification of ARARs will continue through a phased analysis in the FS. An initial list of ARARs for the comprehensive investigation is included in the *OU 7-13/14 RI/FS Work Plan*, duplicated in the *Addendum to the Work Plan*, and updated in the PERA. Further ARAR analysis will be conducted as remedial alternatives are assessed in the FS. The ARARs will be presented to stakeholders in the proposed plan. Three types of ARARs will be defined, as appropriate: chemical-, location-, and action-specific. In cases where ARARs do not exist for a particular chemical, location, or action, pertinent U.S. Department of Energy orders, advisories, or other guidance issued by federal and state agencies may be used. Such resources are identified as to-be-considered guidance and used to supplement promulgated standards identified as ARARs. In combination with results of the BRA, ARARs will be used to establish remediation goals for OU 7-13/14. The final list of ARARs will be included in the ROD.

5.5 Evaluation of Operable Units with Existing Records of Decision

The OU 7-13/14 RI/BRA will assess continued release of VOCs from waste buried in the SDA into the vadose zone and migration of contaminants from Pit 9 and Pad A. The unique organization of WAG 7 to include exposure pathway OUs in addition to discrete release sites necessitates including all OUs with potential to contribute to cumulative risk in the fate and transport modeling for the OU 7-13/14. Therefore, the cumulative risk analysis in the ABRA considered the contributions of OU 7-08 (OCVZ), OU 7-10 (Pit 9 interim action), and OU 7-12 (Pad A) to the total risk at WAG 7. This approach is consistent with INEEL cumulative risk assessments (LMITCO 1995a). Additional evaluation under OU 7-13/14 does not imply reopening the existing RODs for these OUs unless their implemented remedies must be modified to be compatible with the final remedies selected in the ROD for OU 7-13/14.

Organics in the vadose zone were addressed by the OU 7-08 final ROD (DOE-ID 1994a) and successful collection of VOCs from the subsurface is ongoing. Though measures to address the remaining mass of VOCs in the source term may be necessary under OU 7-13/14, it is anticipated that the active OU 7-08 remedial action will be identified as necessary and compatible with remedies selected for OU 7-13/14.

The OU 7-10 ROD (DOE-ID 1993) calls for excavation and removal of all media exceeding remediation goals from Pit 9. The remedy in the Pit 9 ROD was significantly modified because of serious technical difficulties encountered during development of specified excavation and ex situ treatment technologies (DOE-ID 1995a). Pit 9 will not be remediated within the enforceable schedule for OU 7-13/14. Therefore, Pit 9 inventories will be included in the BRA and addressed in the analysis of remedial alternatives for OU 7-13/14 in the FS.

Remedial action at Pad A was designed to address the potential risk from the migration of nitrates to groundwater (DOE-ID 1994b). Based on results of the ABRA, nitrate does not pose long-term hazards (see Table 2), but uranium poses unacceptable risk. Pad A contains approximately 20% of the uranium in the SDA. Because the ABRA identifies uranium as a COC that must be addressed in the FS, remedies identified for OU 7-13/14 will include measures that address Pad A.

5.6 Feasibility Study Long-Term Effectiveness Risk Assessments

Risk assessments will be conducted in the FS to evaluate the short-term and long-term effectiveness of various remedial alternatives. Short-term risks to occupational receptors during remediation will be quantified as for the PERA. Refined long-term risk estimates will be quantified for selected contaminants to assess residual risks to human and ecological receptors after remediation.

Risk assessment methodology for the FS will be developed separately from earlier risk assessments in the IRA and ABRA. Potential benefits of implementing a different set of models will be investigated. Modeling will address vapor-phase radionuclides (e.g., C-14 and H-3) as well as dissolved-phase COCs. Results provided by OU 7-08 will be used to qualitatively assess long-term effectiveness for VOCs. If monitoring data provide adequate targets, models will be calibrated to detected concentrations.

A No Action base case will be developed for the FS as a basis for comparison leading to risk management decisions for WAG 7. Credible exposure scenarios will be defined based on anticipated land-use and other requirements. Because U.S. Department of Energy maintains that institutional controls are required in perpetuity for the SDA, scenarios will be developed for use in determining how institutional controls will be written to compliment appropriate active remedies.

Implementation periods may range from several years for a cap to several decades for retrieval. To ensure a balanced comparative analysis, instantaneous remediation in 2110 will be simulated for all alternatives. Parameter values (e.g., source volumes, release rates, infiltration rates, and distribution coefficients) will be identified to mimic anticipated technology performance. The FS risk assessment results will be used to compare relative long-term effectiveness of remedial alternatives to the FS No Action base case.

6. PROPOSED PLAN

The proposed plan, a secondary document as defined in the FFA/CO Action Plan, will be prepared to facilitate public participation in the remedy selection process for OU 7-13/14. The proposed plan will be prepared after completing a detailed analysis of alternatives and concurrently with the finalization of the RI/BRA and FS reports. Remedial alternatives established during remedial alternative development and screening will be outlined in the proposed plan and features of those alternatives that were subjected to detailed analysis will be summarized. The preferred remedial alternatives for WAG 7 will be presented.

The proposed plan will be written in accordance with EPA guidance (EPA 1999b) and previous experience gained from other INEEL proposed plans. The proposed plan will be submitted to the public and any issues raised during the public comment period will be addressed in the responsiveness summary of the ROD.

7. RECORD OF DECISION

The OU 7-13/14 ROD will be an FFA/CO primary document, and will be prepared in accordance with EPA guidance (EPA 1999b). Following receipt of comments on the proposed plan, remedies will be selected and documented in the ROD for OU 7-13/14. After the OU 7-13/14 ROD is signed by U.S. Department of Energy, IDEQ, and EPA as specified in the FFA/CO, it will become a legally binding agreement.

8. ASSOCIATED REMEDIAL INVESTIGATION AND FEASIBILITY STUDY ACTIVITIES

The INEEL *Community Relations Plan* (DOE-ID 1995b) and the WAG 7 Administrative Record will be maintained at several information repositories throughout Idaho to ensure that RI/FS information is made available to federal and state agencies and interested members of the community during the RI/FS process. The Community Relations Plan and Administrative Record are discussed below.

8.1 Community Relations Plan

The *Community Relations Plan* identifies community relation activities to solicit input from interested members of the community during the OU 7-13/14 RI/FS process. To ensure that local communities have opportunities to participate during the RI/FS process, a schedule for the activities outlined in the *Community Relations Plan* will be published. Members of the public can access information in advance through the INEEL Intranet (http://environment.inel.gov) or by visiting one of the Idaho information repositories in Idaho Falls, Boise, and Moscow.

In addition to the standard RI/FS community relations activities specified in the *Community Relations Plan*, additional fact sheets, briefings, interviews, presentations, and Internet communications specific to WAG 7 will be developed and implemented. The objective of additional outreach activities is to educate, inform, and communicate with stakeholders as the RI/FS progresses to enhance the likelihood of gaining acceptance for the remedies selected for OU 7-13/14.

8.2 Administrative Record

The Administrative Record for OU 7-13/14 is a comprehensive compilation of technical, legal, and informational documents and correspondence. Information in the Administrative Record will be used by the DOE-ID, IDEQ, and EPA to select a remedy as outlined in EPA guidance (EPA 1989b). The Administrative Record is located in Idaho Falls, Idaho, and can be accessed remotely using the Intranet address http://ar.inel.gov/home.html.

9. SCHEDULE AND MILESTONES

The FFA/CO enforceable schedule for OU 7-13/14 was modified in the OU 7-10 Dispute Resolution. Planning and implementation for the OU 7-13/14 RI/FS will be predicated on a 15-month acceleration compared to the enforceable schedule. Both schedules for enforceable deliverables are presented in Table 4. The summary schedule for WAG 7 is shown in Figure 3.

Table 4. Modified Federal Facility Agreement and Consent Order enforceable milestones and working schedule for Operable Unit 7-13/14 primary documents.

Deliverable	Enforceable Milestone	Working Schedule
Draft second addendum—submit to IDEQ and EPA	Not applicable	April 2003
Draft RI/BRA report—submit to IDEQ and EPA	August 2005	May 2004
Draft feasibility study report—submit to IDEQ and EPA	December 2005	September 2004
Draft ROD—submit to IDEQ and EPA	December 2006	October 2005

EPA = U.S. Environmental Protection Agency
IDEQ = Idaho Department of Environmental Quality
RI/BRA = remedial investigation/baseline risk assessment
ROD = Record of Decision

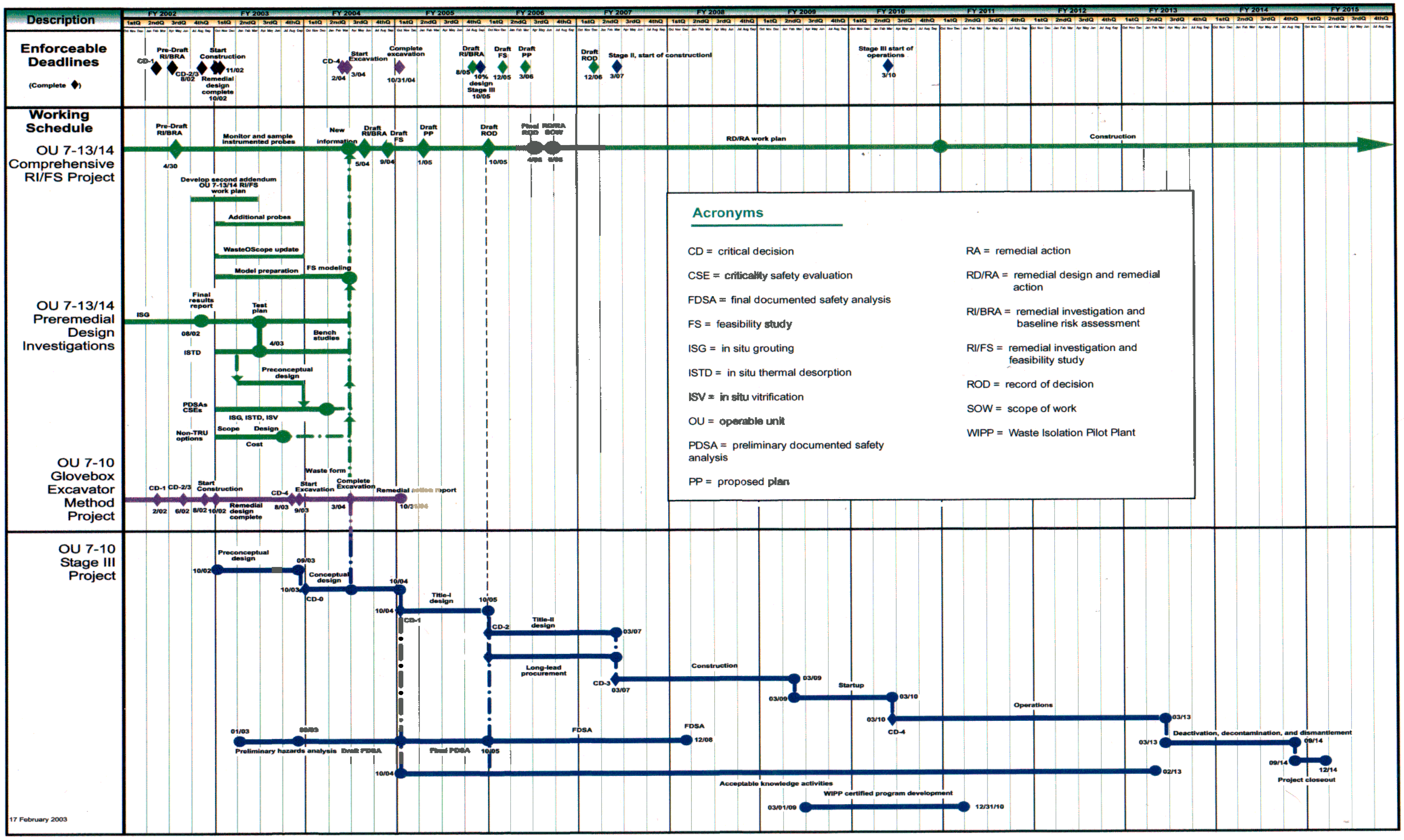

Figure 3. Waste Area Group 7 summary schedule.

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